1   1.   A MIMO-based space-time wireless sensor node and

2   transceiver comprising:

3   a sensor array unit;

4   an A/D converter unit;

5   a signal processing and data computing unit;

6   a MIMO-based space-time transceiver;

7   a memory bank;

8   a power unit;

9   a power generator; and

10   a multiple antenna unit.

11   2.   The MIMO-based space-time wireless sensor node

12   and transceiver of claim 1 wherein the sensor array unit

13   includes N sensors, which each of the sensors is a

14   multimode sensor device.

15   3.   The MIMO-based space-time wireless sensor node

16   and transceiver of claim 2 wherein said multimode sensor

17   device that can be one of electronic, optical, chemical,

18   nuclear fusion, gas/liquid, or any combination sensing is

19   use to sensor different input signals.

20   4.   The MIMO-based space-time wireless sensor node

21   and transceiver of claim 1 wherein the MIMO-based space-

22   time transceiver comprises a sensor data sequence stream, a

23   FEC, interleaver and spreading, a space-time encoding, a

24   modulation and radio frequency transceiver, and a multiple

25   antenna array.

26   5.   The MIMO-based space-time wireless sensor node

27   and transceiver of claim 4 wherein said FEC, interleaver

28   and spreading further includes a convolution encoder, an

29   interleaver, a pseudorandom spreader, a sensor node mask

30   code, and a pseudorandom sequence generator.

31   6.   The MIMO-based space-time wireless sensor node

32   and transceiver of claim 4 wherein said space-time encoding

33   further includes a counterclockwise multirate switch unit,

34   K sensor channel memory banks, K spreaders, an orthogonal

35   sequence generator, a dual-mode switch unit, a block sum,

36   and a serial-to-parallel (S/P).

37   7.   The MIMO-based space-time wireless sensor node

38   and transceiver of claim 6 wherein said counterclockwise

39   multirate switch unit is an interleaver down-sampling

40   operation to produce K parallel sequences of a length of

41   L/K with a chip rate of M Mcps from a single input sequence

42   of a length of L with a chip rate of KM Mcps.

43   8.   The MIMO-based space-time wireless sensor node

44   and transceiver of claim 6 wherein said dual-mode switch

45 unit is used to form either MIMO or SIMO followed by the
46 block sum and the S/P.

47   9. The MIMO-based space-time wireless sensor node
48 and transceiver of claim 6 wherein said orthogonal sequence
49 generator produces all of the sequences with orthogonal
50 each other.

51   10. The MIMO-based space-time wireless sensor node
52 and transceiver of claim 6 wherein each of K spreaders is
53 an exclusive-OR (XOR) operation.

54   11. A MIMO-based space-time sensor basestation
55 comprising:
56   a multiple antenna unit;
57   a demodulation and radio frequency receiver;
58   a space-time processor and decoding;
59   a space-time Rake processor;
60   a deinterleaver and FEC decoding;
61   a MIMO channel estimate; and
62   a pseudorandom sequence generator.

63   12. The MIMO-based space-time sensor basestation of
64 claim 11 wherein the MIMO channel estimate is either using
65 a training sequence or using a blind estimate method for
66 channel identification.

67   13. The MIMO-based space-time sensor basestation of
68   claim 11 wherein said space-time processor and decoding
69   further includes a space-time matrix equalizer, K
70   despreaders, K receiver channel memory banks, a clockwise
71   multirate switch unit, and an orthogonal sequence
72   generator.

73   14. The MIMO-based space-time sensor basestation of
74   claim 13 wherein said space-time matrix equalizer is a
75   space-time MMSE equalizer.

76   15. The MIMO-based space-time sensor basestation of
77   claim 13 wherein said clockwise multirate switch unit is a
78   deinterleaver up-sampling operation to form a single
79   sequence of a length of L with KM Mcps from K parallel
80   sequences of a length of L/K with M Mcps.

81   16. A system of MIMO-based space-time wireless sensor
82   node comprises a power unit coupled to a power generator, $\int$
83   and a power saving mode of operation.

84   17. The system of MIMO-based space-time wireless
85   sensor node of claim 16 wherein the power generator is one
86   of type powers including solar cells, low-power DC source,
87   or any combinations.

88   18.   The system of MIMO-based space-time wireless
89   sensor node of claim 16 wherein the power saving mode of
90   operation further includes a full operation mode, a sleep
91   mode, a wake-up mode, and a partial operation mode.

92   19.   The system of MIMO-based space-time wireless
93   sensor node of claim 18 wherein said sleep mode indicates
94   that the MIMO-based space-time sensor node is in idle.

95   20.   The system of MIMO-based space-time wireless
96   sensor node of claim 18 wherein said wake-up mode is used
97   to randomly wake up the MIMO-based space-time sensor node
98   during setup and to turn the MIMO-based space-time sensor
99   node transceiver off while in inactive.

100   21.   The system of MIMO-based space-time wireless
101   sensor node of claim 18 wherein said partial operation mode
102   is used to operate a sensor array unit, an A/D converter
103   unit, and a signal processing and data computing unit, and
104   can be switched into the full operation mode or the sleep
105   mode.